CDOT Construction Manual

SECTION 200
EARTHWORK

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SECTION 200
EARTHWORK

200.1 GENERAL

Site preparation and earthwork activities on CDOT construction projects should be carefully monitored. This type of work generally involves removing structures and obstructions, clearing and grubbing objectionable and unsuitable materials, excavating and constructing the roadbed embankment, installing temporary and permanent erosion and sedimentation control measures, and handling and disposing non-hazardous and hazardous waste materials. Throughout this type of work, the Contractor is responsible for preserving all protected properties and for complying with all applicable Federal and State laws and local ordinance in accordance with Section 107 of the *Standard Specifications*.

200.2 PRECONSTRUCTION CONSIDERATIONS

The following section presents issues that should be addressed before earthwork begins. Most of these topics should be communicated to the Contractor at the Preconstruction Conference (see Appendix A).

200.2.1 Limits of Construction

The limits of construction define the area in which construction personnel and equipment are permitted to operate. These limits are generally bounded by State right-of-way. Private property may be involved as discussed in Section 200.2.2. Verify that these limits have been properly staked. Stakes and other markings should be preserved until they have served their useful purpose.

200.2.2 Access to Private Property

Access to private property is obtained on a project-to-project basis. Private property access is permitted only through written agreement between the land owner and Contractor. This agreement will define the limits of access, permitted use, and restoration requirements. The Contractor shall furnish the Project Engineer a copy of this agreement before using private property. Periodically check that points of access to all affected private properties remain open during the project. Contact the Region Right-of-Way Manager for assistance.

200.2.3 Utilities and Existing Highway Facilities

The schedule and status of any needed utility adjustment or relocation should be carefully reviewed and clearly understood by all affected parties. Contact the Region Utilities Engineer for assistance.

200.2.4 Historical Sites and Markers

Historical sites and historical markers are scattered throughout the State. Verify that protected historical sites and markers within the limits of construction have been properly marked. Check to ensure that the Contractor is fully aware of the importance of preserving these sites and markers during construction. Contact the Region Planning and Environmental Manager for assistance.

200.2.5 Wetland Areas and Animal Habitats

Ensure that protected wetland areas and animal habitats within the limits of construction are clearly staked or otherwise delineated. Inform the Contractor of the sensitivity of these areas and the importance of their preservation. Contact the Region Planning and Environmental Manager for assistance. See Section 107.13.1 for additional information.

200.2.6 Trees and Shrubs

Verify that protected trees and shrubs are clearly staked or otherwise delineated. Contact the Region Planning and Environmental Manager for assistance. See Section 107.13.2 for additional information.

200.2.7 Highly Erodible Soils

Where clearing and grubbing is required, the limits of clearing in highly erodible areas will be discussed in the Stormwater Management Plan and defined in the Contract Plans. Verify that these areas are clearly staked or otherwise delineated. During construction, the effectiveness of the Best Management Practices employed for erosion and sedimentation control will be inspected for compliance. Contact the Region Planning and Environmental Manager for assistance (see Section 208.1.2).

200.2.8 Archaeological and Paleontological Sites

Ensure that archaeological and paleontological sites discovered during the Site Investigation are clearly staked or otherwise delineated. Ensure the Contractor understands the importance of preserving these resources. If unforeseen archeological or paleontological discoveries are encountered during construction, the Contractor's affected operations shall immediately cease and the Region Planning and Environmental Manager shall be notified. See Section 107.23 additional information.

200.2.9 Hazardous Operations

As governed by Section 107 of the *Standard Specifications*, the Contractor is solely responsible for adhering to Federal and State laws and local ordinances with respect to the safety of project personnel and the general public. Periodically review construction operations for obvious signs of non-compliance. Explosives handling, blasting operations, felling of timber, and burning of debris present significant hazards. Immediately notify the

Project Engineer of any suspect operation. Contact the CDOT Safety Officer for assistance.

200.2.10 Hazardous Material/Hazardous Waste

Ensure that all suspected hazardous material/hazardous waste sites that have been identified during the Modified Environmental Site Assessment and Site Investigation are properly staked or otherwise delineated. All special requirements of the Contract should be strictly enforced. Also ensure that the notification flowchart presented in Figure 200A of Section 250.2.5.1 has been completed and posted. Contact the Region Planning and Environmental Manager who in turn will confer with Hazardous Materials in Safety Services and Hazardous Waste in the Property Management Unit. See Section 250.2 for additional information.

200.2.11 Salvable Materials

Salvable materials that become the property of the Department must be carefully removed in sections and properly marked and stored. Where required, check that the Contractor utilizes match markings for the reassembly of structures. Check the provisions of the Contract for special requirements. Verify that the Contractor is aware of the disposition of all salvable material before earthwork activities begin. Inspect materials for damage if they are to be reused on the project. See Section 200.2.2 where materials must be stored on private property.

200.2.12 Stakes and Survey Monuments

Check stakes for compliance with Section 625 of the *Standard Specifications* and to ensure that all survey benchmarks, monumentation, and stakes are adequately marked and preserved during the project. Contact the Region Right-of-Way Manager for assistance.

200.2.13 State Noxious Weeds

All mulch, seed, sod, plants, shrubs and other similar biological material must be free from noxious weeds to minimize their propagation. Noxious weeds are plants that are detrimental to the health and well-being of other living organisms within the State, as determined by the Colorado Department of Agriculture. This should be discussed with the Contractor at the Preconstruction Conference and reiterated at Project Progress Meetings before operations such as seeding, sodding, planting, and mulching begin. Contact the Natural Resources Staff in Environmental Programs for additional information.

200.2.14 Visual Documentation

Visual aids can substantially complement the written documentation required by the Department, especially when claims and litigation are anticipated. Prior to and during the project, use cameras and video recorders to document field results.

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SECTION 201
CLEARING AND GRUBBING

201.1 GENERAL REQUIREMENTS

Clearing and grubbing are specified on projects to eliminate all unsuitable material from roadway excavation material and embankments. If organic material is allowed to remain, it will rot and create voids within or under the compacted embankment material. As the embankment material settles to fill the voids, a pavement failure will generally occur. In addition, all branches within 20-feet clear height above the subgrade must be pruned and the cut surface properly treated.

201.1.1 Excavation Areas and Borrow Pits

One objective during roadway design is to balance cuts with fills by reusing excavated material further ahead in station to construct embankments; thus minimizing construction costs. The excavated material is not always suitable for use in roadway embankments. In these areas, specially located borrow pits are used for the additionally needed material. Both excavated and borrowed material must not only be suitable in terms of soil characteristics, but also free from organic matter. Clearing and grubbing is typically specified for excavation areas and borrow pits to completely remove organic matter such as trees, undergrowth, stumps, roots, and ground cover.

201.1.2 Embankment Areas

For embankment areas, the treatment of stumps and vegetation depends on many factors as discussed in this section.

201.1.2.1 Fills Greater Than Four Feet

Many contracts require the underlying embankment foundation to be pre-compacted, which necessitates complete clearing, grubbing, and removal of organic ground cover. If pre-compaction is not specified, however, and the fill (i.e., as measured from natural ground line to subgrade) is greater than four feet, the following practice is acceptable:

1. Vegetation. Vegetative matter may be mowed and remain in place.

2. Stumps. Stumps may be cut to a height of six inches above the natural ground and remain in place. One exception to this practice is where the stump is within two feet of the toe of the fill slope, which requires complete stump removal.

201.1.2.2 Four-Foot Fills or Less

For fills that are four feet or less (i.e., as measured from natural ground line to subgrade), the following practice must be followed:

1. Vegetation. All vegetative matter must be completely stripped.

2. Stumps. Stumps may be cut to a height within six inches above the natural ground and remain in place. However, there is a condition to this practice: the final embankment must have a at least two feet of compacted fill material between the resulting subgrade or side slope and the top of the stump.

201.2 INSPECTION GUIDELINES

201.2.1 Before Construction

Before clearing and grubbing begins, review the preconstruction considerations presented in Section 200.2. In addition, verify acceptability of the Contractor's proposed method of debris disposal.

201.2.2 During Construction

1. Blasting. Consult the Project Engineer if violations are suspected.

2. Stumps and Vegetation. Verify that vegetation and stumps are treated consistent with the criteria presented in Section 201.1. Treatment depends on many factors including fill height and location.

3. Objectionable Material. Verify that objectionable materials are removed and backfilled as specified in the Contract. Ensure that objectionable materials are not mixed with excavated material.

4. Tree Branches. Verify that tree branches are pruned to the required vertical clearance. Ensure that unsound and unsightly branches are also pruned. Pruning must be performed using good tree surgery practices.

5. Debris Disposal. Check that debris is disposed of properly and that approved burning operations are performed safely and within legal limits.

201.2.3 After Construction

A newly cleared site is vulnerable to erosion. Check the Stormwater Management Plan and the provisions of the Contract with respect to the Best Management Practices required for erosion and sedimentation control. See Section 208 for additional information.

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SECTION 202
REMOVAL OF STRUCTURES AND OBSTRUCTIONS

202.1 GENERAL REQUIREMENTS

All structures and obstructions marked for demolition within the limits of construction must be safely removed and properly disposed. The trenches, holes, or pits resulting from such activities must be backfilled and compacted. Unless otherwise directed, backfill that is placed below or outside the roadway prism (e.g., below subgrade) will be placed and compacted as close as practical to the density of the in situ soil. Backfill placement and compaction within the roadway prism will be performed as specified in the Contract.

202.2 INSPECTION GUIDELINES

202.2.1 Before Construction

Consider the following guidelines before removal of structures and obstructions:

1. Methods of Removal. Prior acceptance by CDOT of the Contractor's methods of removal may be necessary. Check the provisions of the Contract.

2. Damage to Structures. Do not allow any construction method or equipment operation to continue if it could damage an adjacent structure or portion of structure designated to remain in place.

3. Blasting. The handling of explosives and blasting operations will be performed as specified in the Contract.

4. Measurements. Many items designated for removal will require measurement for payment prior to the actual removal work (e.g., curb & gutter, sidewalk). Measure and mark these items and ensure that the Contractor understands the limits of removal.

202.2.2 During Construction

1. Salvable Materials. If culverts are to be reused, ensure they are removed without damage and properly stored. See Section 200.2.11 for additional information.

2. Pavements and Sidewalks. Where the Contract specifies complete removal of pavement, sidewalks, curbs, etc., verify removal to the proper width and depth. Check that the material is disposed of properly. Some contracts may specify material recycling. Check the provisions of the Contract. If partial removal is specified, verify that sawed cut lines are true and maintained.

3. Basements. Basements and other similar cavities that are left by demolition must be filled and compacted in accordance with the requirements of the Contract. Special attention is needed to achieve uniform density in such areas.

4. Maintenance of Traffic. Verify that pavement markings are completely eradicated before new traffic patterns are established. Check the Contract Plans for conformance with the Maintenance of Traffic Plan. See Section 630 for additional information.

5. Bridges. Check for removal to the proper depth (e.g., columns, abutments, footings).

202.2.3 After Construction

Items to be removed are sometimes removed in sections or a portion at a time. Where partial removal is necessary, carefully check the site to ensure that the remaining portion of the item does not impose a public hazard or compromise adjacent property (e.g., the remaining structure appears unstable, a section of guardrail is left exposed without proper end treatment). Prior to reopening roadways to traffic, also check that all debris has been removed from the roadway.

SECTION 203
EXCAVATION AND EMBANKMENT

203.1 GENERAL REQUIREMENTS

Excavation and embankment (i.e., generally referred to as earthwork) is the construction of a graded roadbed, upon which subsequent base and wearing courses are constructed. Excavation is that part of the earthwork that is dug up, hauled, or reused as fill material to construct the embankment portion of the roadbed. Roadway excavation, which is that material obtained from within the right-of-way exclusive of structural excavation, may be composed of common earth, solid rock, loose rock, or any combination of these materials. Where there exists insufficient quantities of suitable roadway excavation and structural excavation for embankment construction (i.e., cuts do not balance with fills), borrow excavation is specified to make up the difference.

203.1.1 Excavation

203.1.1.1 Types of Excavation

1. Rock Excavation. Rock excavation includes all masses of material that cannot be removed without blasting or ripping and all detached stones or boulders having a volume of 0.5 cubic yards or more as determined by physical or visual measurement.

2. Unclassified Excavation. Unclassified excavation includes all materials encountered regardless of their nature or the manner in which they must be removed.

3. Muck Excavation. Muck excavation provides for the removal and disposal of saturated or unsaturated mixtures of soil and organic matter that are not suitable for a foundation material or embankment.

4. Borrow Excavation. Borrow excavation consists of approved material, required for embankments or other portions of work, acquired from outside the right-of-way.

5. Stripping. Stripping consists of the removal of overburden or other specified material from pits before the underlying material is excavated for use in the roadway. Stripping also includes replacing the stripped material.

203.1.1.2 Excavation Near Wetlands

Excavation in and near wetland areas should be carefully monitored for compliance with environmental requirements. Non-permitted encroachment of wetland areas is unacceptable. Such practices may cause permanent damage to these protected areas and result in litigation. See Section 107.13.1 for additional information.

203.1.2 Embankment Construction

203.1.2.1 Embankment Materials

1. Embankment Material. Embankment material consists of approved material acquired from excavation, hauled, and placed in embankments.

2. Rock Fill. Rock fill is stone, boulders, or broken rocks, not less than six inches in least dimension, that consists of at least 50 percent material having a volume of two cubic feet or more as determined by physical or visual measurement.

3. Rock Embankment. Rock embankment consists of material with 50 percent or more by volume, at field moisture content, of particles with least dimension diameter larger than No. 4 sieve and smaller than six inches.

203.1.2.2 Foundation Inspection

Before embankment construction begins, carefully inspect the area that will serve as the embankment foundation. Pay particular attention to areas that have questionable supporting capacity. Where soft or very wet areas are found, consider the following:

1. Unsuitable Materials. If the material is found to be unsuitable, it must be replaced with a material that is suitable for use as an embankment foundation.

2. Springs/Seeps. Where springs or seeps are found, underdrain facilities may be required to adequately remove the spring or seepage water.

3. Poor Surface Drainage. The material may have become saturated due to poor surface drainage. Saturated material must be dried.

203.1.2.3 Embankment Uniformity

The importance of uniformity in embankment construction cannot be overemphasized. Practical construction methods that ensure uniformity of material, layer thickness, moisture content, and compactive effort are paramount in achieving a quality embankment. Most roadway failures can generally be traced to a lack of uniformity in the embankment.

203.1.3 Steep Slopes and Transitions

Where embankments are constructed on steep slopes, a good interlock must be achieved between the sloping foundation and the new embankment material. Material interlock can be effectively achieved by plowing, terracing, or benching the foundation slope. Consider the following guidelines:

1. Vegetation. Vegetation on very steep slopes must be completely removed to prevent the creation of a slip plane between the foundation slope and the new embankment material.

2. Hard Sloping Surfaces. Slopes that have a relatively hard surface will create a slip plane unless properly treated. Such slopes must be plowed, terraced, or benched to properly key the embankment material as it is placed and compacted.

3. Existing Embankments. Where existing embankments are widened or raised in terms of grade, plowing, terracing, or benching are used to key the new material into the existing embankment.

4. Transition Areas. Benching is used in the transition area between sizable cuts and fills. The transition area is the point where a cut section changes to a fill section. Particular attention should be placed in these areas. Failure to provide sufficient transverse benching and uniformity in compaction generally will result in a rough pavement surface at this junction.

203.2 INSPECTION GUIDELINES

203.2.1 Before Construction

In addition to the general preconstruction guidelines presented in Section 200.2, consider the following before excavation and embankment construction begins:

1. Utilities. Know the location of utilities and the status of any relocation work. Note any encroachment permits (see Section 200.2.3).

2. Environmental Considerations. Verify compliance with respect to erosion and sedimentation control, vegetation and tree protection, wetlands, and other environmental requirements. Make certain that protected wetland areas are marked and communicated to the Contractor (see Section 200.2.5 and Section 200.2.6).

3. Types of Excavation. Understand the types of excavation that will be required for the project (see Section 203.1.1.1). Verify that borrow sites, where used, have been approved and that cross-sections have been taken. Where explosives and blasting are required for rock excavation, verify compliance with the Contract Specifications.

4. Compaction Considerations. Become familiar with and understand the moisture and density requirements for embankment construction. Check the provisions of

the Contract for any required special compaction equipment. Understand the proper operation of such equipment.

5. Typical Sections/Staking. Become familiar with the typical sections of the Contract Plans. Pay particular attention to required treatments for steep slopes and transition areas (see Section 203.1.3). Verify that slope stakes are properly set (see Section 200.2.12). Visually check staking for obvious irregularities (e.g., off right-of-way).

6. Foundation Inspection. Observe the area for unsuitable material and wet spots. Verify removal or treatment based on the direction given by the Project Engineer. Document the locations, quantities, and disposition of materials and treatments. See Section 203.1.2.2 for additional information.

203.2.2 During Construction

Consider the following guidelines during excavation and embankment construction:

1. Blasting and Explosives. Monitor any handling of explosives and blasting operations for conformance with legal requirements (see Section 200.2.9).

2. Slide Areas. Be alert to any condition that could indicate a possible slide area.

3. Slope Stake Preservation. Make certain the Contractor preserves slope stakes and control point references during the operation (see Section 200.2.12).

4. Clearing and Grubbing. Verify that the site has been properly cleared and grubbed (see Section 201).

5. Excavated Materials. Observe and report noticeable changes in excavated material with regard to type, texture, and color. Such factors may indicate the presence of unsuitable materials. Verify removal based on directives from the Project Engineer. Document the locations, quantities, and disposition of such materials. Watch for encounters with materials that could be used elsewhere (e.g., topsoil, riprap).

Where topsoil stripping is specified, ensure that topsoil is properly salvaged (see Section 207).

6. Base of Cut/Top of Slope. Verify that rock encountered at the base of cuts has been excavated to the proper grade. Observe that rounding along the top of cut slopes is performed where specified.

7. Subexcavated Areas. Ensure that subexcavated areas have been measured for payment before backfilling.

8. Drainage and Erosion. Verify ditch construction (e.g., typical sections, staking, natural drainage, interceptor ditches at tops of cuts). Watch for damage to the embankment (e.g., unexpected high water with respect to design, improperly drained foundation or roadbed, damage from precipitation). Ensure that the Best Management Practices for water quality control are monitored as required (see Section 208.1.2).

9. Benching. Verify that slopes and transition areas are being treated as specified with regard to keying the new material (see Section 203.1.3).

10. Embankment Material. Check to ensure that the embankment is maintained free of organic and frozen materials and uniformly mixed. Rocks, concrete, and asphalt chunks larger than allowable dimensions must be removed and disposed of properly.

11. Placement and Compaction. Verify that the embankment material is placed in uniform horizontal lifts that do not exceed the allowable maximum thickness. Note the use and permissibility of any end dumping. Observe the compaction operation for uniformity with respect to moisture content and target density. Monitor the operation of specialized compaction equipment for compliance. Check that the top two feet of embankment is constructed with rock free material.

12. Structure/Pile Locations. Ensure that embankment material is being placed to avoid damage to adjacent structures. Oversize material should not be used around structures or pile driving locations.

13. Debris Disposal. Roots, logs, and other unsuitable materials must be disposed of in designated areas outside the fill area.

14. Cross-Sections. Frequently monitor the earthwork cross-section (e.g., width, side slopes, grade) for conformance with regard to tolerance of typical sections.

203.2.3 After Construction

After construction, verify that the roadway grade and prism are within specified tolerance and that embankment construction meets the density requirements of the Contract. Check the installation of drainage facilities for proper operation and that the Contractor maintains the roadbed in proper condition.

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SECTION 206
EXCAVATION AND BACKFILL FOR STRUCTURES

206.1 GENERAL

Where the project includes work on structures, excavation and backfill operations will be specified in the Contract.

206.1.1 Contractor Responsibility

Construction requirements for excavation and backfill for structures are specified in Section 206 of the *Standard Specifications*. The limiting nature of this criteria (e.g., minimum cover over pipe, backfilling evenly on opposite sides of the structure) does not relieve the Contractor from responsibility for failure or damage caused by unsound construction practices. The Contractor also must consider and effectively use the guidance and recommendations provided by product manufacturers and suppliers. CDOT will not consider participating in the repair or replacement of work if the failure or damage is caused by the fault or negligence of the Contractor.

206.1.2 Damage and Failure Considerations

Structural damage and failures can be avoided if sound construction practices are used in the backfill operation. The Project Inspector should monitor the operation for obvious signs of unsound practices and bring any instances to the attention of the Project Engineer. Factors that typically contribute to structural damage and failures include:

- the presence of rock in backfill material,
- uneven backfilling on opposing sides of the structure,
- backfilling too soon against freshly poured concrete,
- placement of backfill material in lifts that are too thick,
- providing insufficient cover over pipe structures, and

- operating heavy equipment too close to pipe structures.

CDOT Plans and Specifications are designed so that backfilling operations can be accomplished without causing structural damage or failure, provided that sound construction practices are employed.

For example, the structural integrity of a large diameter steel pipe relies on the side support provided by the compacted backfill material. If this side support is not adequately developed, the structure may fail. Such types of failure can generally be attributed to a lack of uniformity in the compacted backfill material. It is critical that such operations be carefully monitored for compliance.

206.2 INSPECTION GUIDELINES

206.2.1 Before Construction

1. Contract Plans and Specifications. Review the Contract for any special requirements. Know and understand the requirements for excavation and the class and quality of backfill material specified. Take cross-sections and profiles, as needed, for verification.

2. Payment Factors. Upon receipt of the Contract Plans, consider developing a payment factor for each structure (i.e., factor = total trench volume divided by total length of structure). If, for example, an installed pipe differs from the plans in length but not in cross-section, the factor can be used to quickly adjust final pay quantities.

3. Staking. Check stakes for any irregularities.

4. Structure Inspection. Compare the Contract Plans to the site. Inspect and note the condition of the structure. Make certain that structural concrete has attained the minimum required strength before backfilling.

206.2.2 During Construction

1. Unsuitable Materials. Verify that unsuitable materials have been properly excavated and removed. Document the location, quantity, and disposition of the material.

2. Embankment. Embankment must be completed, where required, for structures located above natural ground.

3. Excavation Limits. Check excavated limits, dimensions, and grades. Document quantities.

4. Trenching. OSHA has strict regulations regarding the provision of shoring in trench operations. As required by Section 107 of the *Standard Specifications*, such operations are entirely the responsibility of the Contractor. Verify that shoring and side slope treatments are being installed where required.

5. Base of Excavation. The base of excavation must be firm and comply with specified requirements. Check the base to ensure it has been properly drained and prepared for any placement of concrete.

6. Pipe. Check the adequacy of the pipe bedding and bed treatment, especially where rock is present. Check the direction of flow, camber, cradles, etc. Pushing the pipe out of line or raising the pipe off its bed during backfilling is unacceptable. Pay particular attention to the backfill material. Direct contact with rock greater than two inches may cause failure in steel pipe.

7. Compaction. Use extreme caution when backfilling and compacting. Stress uniformity. Verify material lifts, moisture, and the compaction operation for compliance. Do not exceed optimum moisture content. Helical pipe has been known to fail where A-6 and A-7 soils are used. Note any quantities that are not consistent with the Contract.

8. Hazards. During excavation and backfill operations, protruding structures and surface cavities pose significant hazards to workers and equipment. Check that these types of hazards are clearly marked to prevent mishaps and equipment damage.

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SECTION 207
TOPSOIL

207.1 GENERAL

Topsoil obtained from below original ground level in fill sections will increase the quantity of embankment material required to complete construction. Topsoil obtained from cut sections will reduce the material available with which to construct the embankment.

207.2 INSPECTION GUIDELINES

207.2.1 Before Construction

Consider the following guidelines before the topsoil operation begins:

1. Source/Approval. Verify the source and prior approval of the material.

2. Slope/Depth. Existing slopes must be acceptable. Note the depth desired for topsoil.

3. Stockpiling. Know if stockpiled topsoil is a part of the Contract.

207.2.2 During Construction

Consider the following guidelines during the topsoil operation:

1. Objectionable Material. Check for the proper removal of debris, roots, heavy clay, hard clods, brush, toxic substances, and stones larger than six inches from the area requiring topsoil. Check topsoil at the site for the presence of State noxious

weeds. If State listed noxious weeds, seed, or reproductive vegetative plant parts are present, reject the topsoil. Management controls may be required.

2. Tilling/Scarification. Verify that tilling or scarification is being performed at the specified depth. Check for cross-tilling, where required. Ensure that topsoil is not applied over untilled or unscarified areas.

3. Distribution. Check that the Contractor is evenly distributing the topsoil at the specified depth.

4. Compaction. Check the acceptability of the compaction operation. Over-compaction is unacceptable. Pre-compaction will generally become unnecessary when topsoil is obtained from the roadway.

5. Grading. Check grades and make certain provision is made for adequately draining surface water, especially away from buildings and other improved structures. Check the finished grade for conformance and tolerance.

6. Seeding Considerations. Verify light rolling, fine grading, raking, and depth of tillage. Observe whether there are excessive clods in seed beds. Determine the need for discing and harrowing to provide an acceptable seed bed.

207.2.3 After Construction

Check the Stormwater Management Plan of the Contract Plans for the Best Management Practices for erosion and sedimentation control that may be required upon completing the placement of topsoil. See Section 208 for additional information.

SECTION 208
EROSION CONTROL

208.1 GENERAL

Erosion control work consists of the construction, installation, maintenance, and removal of erosion control measures used during the life of the project. This work prevents or minimizes erosion, sedimentation, and pollution of State waters and wetlands. Erosion and sedimentation control measures will be constructed and maintained in accordance with the Best Management Practices designated in the Stormwater Management Plan for the project. Additional design information can be obtained from the *CDOT Erosion Control and Storm Water Quality Guide* and the *CDOT Erosion and Sediment Control Pocketbook*.

208.1.1 Erosion and Sedimentation Process

Erosion and sedimentation are natural processes whereby soil materials are detached and transported from one location and deposited in another due to the action of water, wind, ice, and gravity. Erosion can take many forms including sheet, rill, gully, and channel erosion. The erosion potential of a particular area is determined by interrelated factors including soil characteristics, vegetative cover, topography, and climate.

208.1.2 Water Quality Management Requirements

208.1.2.1 Stormwater Management Plan

The Region Planning and Environmental Manager or the Natural Resources Staff in Environmental Programs will prepare a Stormwater Management Plan during the design phase of all CDOT construction projects having earth disturbances subject to erosion, which includes all projects requiring a permit as discussed in Section 107.25.4 of this *Manual*. Stormwater Management Plans generally are not prepared for projects having little or no earth disturbance (e.g., overlay projects with minor shoulder work). The

Stormwater Management Plan will be included in the Contract and will define the Best Management Practices required for water quality control.

208.1.2.2 Best Management Practices

Best Management Practices are schedules of activities, prohibitions, and practices that are used to control erosion and sedimentation and minimize pollution of stormwater runoff and receiving waters both during and after construction. Best Management Practices may be categorized as follows:

1. Soil Stabilization Practices. Soil stabilization practices (e.g., seeding, mulching, sodding) are temporary or permanent treatments that stabilize and protect exposed earthen surfaces from erosion due to rainfall, overland flow, and runoff.

2. Structural Practices. Structural practices (e.g., hay bales, silt fences, check dams) are temporary or permanent treatments that protect soil surfaces from erosion by interrupting, diverting, and/or storing the flow of runoff.

3. Pollution Mitigation Practices. Best Management Practices also include pollution mitigation practices that are used to protect receiving waters from pollutants other than sediments due to erosion (e.g., spill prevention, waste disposal).

Design and construction criteria for specific Best Management Practices are presented in the *CDOT Erosion Control and Storm Water Quality Guide* and the *CDOT Erosion and Sediment Control Pocketbook*.

208.1.2.3 Erosion Control Supervisor

A pay item for an Erosion Control Supervisor will be specified in the Contract for Projects that have significant earth disturbance or with operations in highly erodible areas. The Contractor is responsible for providing the Erosion Control Supervisor. The Erosion Control Supervisor must have satisfactorily completed an authorized Erosion Control Supervisor Training Program. The Contractor must provide proof of such training

to the Project Engineer. A list of authorized training programs may be obtained from Environmental Programs in the Project Development Branch.

The Erosion Control Supervisor will ensure compliance with all permits and specifications and directly supervise the installation, construction, and maintenance of the Best Management Practices for the project. The Erosion Control Supervisor is required to conduct inspections every 14 days and after each storm event that causes surface runoff. The Project Engineer, or authorized delegate, will accompany the Erosion Control Supervisor on these inspections. The results of each inspection will be documented on Form 1176 – Erosion and Sediment Control Field Inspector's Report and retained in the project files. Contact the Region Planning and Environmental Manager for further assistance.

208.2 INSPECTION GUIDELINES

208.2.1 Before Construction

Consider the following guidelines before erosion control work begins:

1. Schedule Review. Review the Contractor's schedule for temporary and permanent erosion control measures to ensure proper coordination with other construction activities. Emphasize the importance of this schedule to the Contractor.

2. Training Requirements. Verify that the individual assigned as the Erosion Control Supervisor has met the training requirements specified for the Contract (see Section 208.1.2.3). Determine if the Erosion Control Supervisor is required to measure water quality.

3. Stormwater Management Plan. Review the Stormwater Management Plan and fully understand the types and locations of the Best Management Practices that are to be employed. Verify that the Contractor fully understands the requirements.

4. Environmental Preconstruction Conference. Verify that environmentally sensitive areas, and other areas to be preserved as discussed in Section 200.2, are clearly marked and communicated to the Contractor. If specified, an Environmental Preconstruction Conference will include an on-site review of the environmental

issues of the project (e.g., landscape, water quality, wetlands, cultural, hazardous materials, threatened and endangered species). The Conference should include a team of CDOT and Contractor representatives assigned to the project. The minutes of the meeting should be prepared and distributed to all affected parties.

208.2.2 During Construction

Consider the following guidelines during the inspection of erosion control work:

1. Construction Sequence. Check to ensure that construction activities are sequenced and staged in accordance with the requirements of Section 208 of the *Standard Specifications.*

2. Installation Review. Review the installation of the Best Management Practices closely, and document the appropriate pay quantities on CDOT Form 266 – Inspector's Progress Report.

3. Erosion Control Supervisor. A CDOT representative must accompany the Erosion Control Supervisor on all inspections. Ensure that the Erosion Control Supervisor completes Form 1176 – Erosion and Sediment Control Field Inspector's Report. Retain these forms in the project files.

4. Sedimentation. Check the sediment buildup behind erosion control features to ensure that it is being removed as required and document findings on Form 103 – Project Diary.

5. Disincentive. As needed, enforce the provisions of the Contract contained in the *Standard Special Provision, Revision of Section 208 – Erosion Control* with respect to disincentives.

208.2.3 After Construction

Consider the following guidelines after construction:

1. Removal of Temporary Installations. Upon completion of the project, temporary erosion and sediment control features that have served their useful purpose will be removed by the Contractor, unless otherwise specified by the Project Engineer.

2. Sediment Disposition. Sediment removed during maintenance of erosion control features will be used in or on embankments, provided the material meets the requirements of Section 203 of the *Standard Specifications*, or wasted in accordance with subsection 107.25 of the *Standard Specifications*.

3. Final Walk-Through. Perform a final walk-through with maintenance personnel. Note any location of erosion and sediment control measures that will require future maintenance or subsequent removal.

4. Inspections. The Project Engineer is required to continue inspections until the site is stabilized/established and the Best Management Practices are removed.

5. Closure of Permit. In accordance with NPDES permit requirements, a project must be 80 percent stabilized before the permit may be closed. The Project Engineer will contact the Region Planning and Environmental Manager for the project review to close the permit.

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SECTION 209
WATERING AND DUST PALLIATIVES

209.1 GENERAL

Water typically is used on projects for such purposes as compaction, seeding, sodding, planting, transplanting, and dust control. Where paid for separately, a complete record of the quantities of water used must be maintained.

209.2 INSPECTION GUIDELINES

209.2.1 Before Construction

Consider the following guidelines before construction begins:

1. Contract Plans and Specifications. Review the Contract with regard to application rate and any special requirements of the project.

2. Source Approval. Check to verify that the source of material has been properly approved.

3. Haul Trucks/Quantities. Establish the method of measuring and documenting quantities. Establish truck identifications and determine and record the capacity of each haul truck to be used on the project for load count and documentation purposes.

4. Water Meters. Obtain the necessary water meter certifications in accordance with subsection 209.02 of the *Standard Specifications*. Retain these certifications in the project records. Ensure that meters are as close to the distribution point as practical. Verify that the outfall pipe from the meter is full and operating under the required pressure. Note any leaks.

5. Soil Classification/Application. The Project Inspector and the Project Engineer should discuss the soil classifications, required application rate, and equipment operation. Application must be uniform. Be alert to small and remote areas that are difficult to water.

6. Equipment and Methods. Methods and equipment are the Contractor's option. Project Inspectors do not have the authority to specify methods or equipment.

209.2.2 During Construction

Consider the following guidelines during construction:

1. Runoff/Ice. Note the presence and approximate quantity of runoff when prewetting. In cold weather, watch for excessive ice buildup.

2. Small Areas. Check small and remote areas to ensure they are not missed. Moisture content in the soil material must be uniform.

3. Verify Calibration and Quantities. Verify the calibration of equipment and the quantities reported. Watch for loads being spread or dumped in unauthorized places. Compare daily totals with daily production and note any wasting. Immediately investigate unexplained variations.

209.2.3 After Construction

Pay particular attention to locations where water has ponded and where excessive runoff has caused erosion. Areas of ponding indicate possible problems with the finished subgrade. These problem areas could be either a design deficiency or a deficiency on the Contractor’s part. Investigate these situations because such areas may need mitigation with temporary erosion control treatments (see Section 208).

SECTION 210
RESET STRUCTURES

210.1 GENERAL

Unserviceable material will be replaced with new material when the Project Engineer determines that this is necessary. New material required for this pay item will be paid for in accordance with subsection 109.04(b) of the *Standard Specifications*. Guardrail and sign posts are two of the most common items requiring new material and/or hardware where reset. Make certain that the items needing replacement were not damaged by Contractor personnel.

210.2 INSPECTION GUIDELINES

210.2.1 Before Construction

Consider the following guidelines before barriers (e.g., guardrail, concrete barriers, transitions, end treatments) are reset or installed:

1. Stakes. Check that stakes are set in their proper location.

2. Contract Plans and Specifications. Review the Contract and become familiar with the installation requirements of the particular type of guardrail being reset or installed. Also note any requirements for concrete barrier, transitions, and end treatments. Note any peculiar material requirements.

3. Materials. Verify the condition of existing and new materials. The materials must be clean, sound, and serviceable. Verify that the Contractor has furnished the necessary Mill Test Reports and that hardware meets specified requirements. Check the adequacy of any shop bent rail. Verify that concrete and reinforcing steel for concrete barriers meet specified requirements.

210.2.2 During Construction

Consider the following guidelines during the resetting or installation of barriers:

1. Storage and Handling. Materials and hardware must be properly stored and handled to avoid damage. Verify the proper repair and recoating of damaged material. Review and verify compliance with the storage provisions of the Contract. Verify proper disposal of unusable materials and the storage and safekeeping of salvable materials.

2. Posts. Ensure that posts of different types are segregated by groups. If a post has been cut, check that the surface has been properly treated. Make certain that voids under posts are filled with concrete mixture, where required. With respect to meeting Contract requirements, consider the following additional factors when inspecting posts:

   - type of posts and blockouts required (wood or steel);
   - laboratory inspection requirements for wood posts;
   - post and blockout dimensions;
   - procedures and tolerance for setting posts with respect to rail height;
   - backfilling requirements (i.e., material and procedure);
   - required treatment for cut posts; and
   - requirements for nailing blockouts in place.

3. Unserviceable Items. The Contractor may be reimbursed for furnishing new material for reset items that are not usable. Make sure that damaged items are not the cause of the Contractor. Such damaged items will be restored, repaired, or replaced at the Contractor's expense.

4. Rail Height. It is critical to check that the height of rail is being reset to that specified in the Contract Plans.

5. Protection of Traffic. Verify that the Contractor is providing adequate protection to the traveling public from sections that are not complete. Check that installation proceeds in the direction specified. Verify the proper direction of rail lapping. At the end of the work day, check that rail ends have been properly addressed.

6. Assembly. Verify compliance with the Contract Plans and Specifications. Check washers, bolts, and rail horizontal and vertical alignment. Check that bolts extend beyond the nuts and are being securely tightened. Verify that the rail is being installed in a smooth, continuous vertical and horizontal alignment.

7. Deadmen. Where deadmen are required, verify proper installation.

8. Concrete Barriers. Consider the following during the inspection of concrete barrier installation or resetting:

    a. Concrete Finish. Inspect the finishing of the concrete for compliance.

    b. Lift Holes. Verify that lift holes in precast sections are being filled with approved material where required.

    c. Trench/Base. Check trench construction for cast-in-place barriers, or the base for precast barriers, for compliance with the Contract Plans.

    d. Alignment. Check the longitudinal alignment of the barrier with a 10-foot straight edge for conformance.

    e. Transition. Verify the connection between the concrete barrier and the guardrail for compliance. Different types may be specified.

9. Reflectors. Check that the reflector tabs are being installed as specified.

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SECTION 212
SEEDING, FERTILIZER, AND SODDING

212.1 GENERAL

Seed, fertilizing, and sodding are specified on projects for both landscaping and erosion and sedimentation control purposes. Contact the Natural Resources Staff in Environmental Programs for further information.

212.1.1 Landscape Applications

For landscapes to be successful, proper topsoil preparation, adequate fertilization, healthy plants and quality seed material, judicious watering, and proper follow-up care must be performed.

212.2 INSPECTION GUIDELINES

212.2.1 Before Construction

Consider the following guidelines before seeding, fertilizing, and sodding are performed:

1. Seed Material. Verify the mixture, names, purity, germination, weed content, and date of last test on seed labels for compliance. Retain seed labels and vendor statements for the project records. Verify certification requirements (i.e., Contractor furnished, laboratory tests). Verify that the pure-live-seed content has been determined based on the formula in the Contract Specifications. Check condition of seed for water, insect, and mold damage. Enforce the provisions of the Contract with respect to rejection. Ensure the mixture is free from State noxious weeds (see Section 200.2.13).

2. Fertilizer Material. Check the bag label for compliance with respect to mixture type (e.g., pellet or granular), percent, and class. Retain labels for project records. Check certification requirements (e.g., Contractor furnished, soil tests). Verify that the fertilizer is delivered in unopened containers.

3. Mulch Material. Where mulch is required, see Section 213.

4. Plant Material. Where plants are required, see Section 214.

5. Sod Material. Verify from grower certificates that sod is of the correct species. Retain certificates for the project records. Make certain the rectangular sections of sod have uniform widths, retain native soil on roots, and are the specified thickness. Sod should be placed within 24 hours of being cut. Check to ensure sod is maintained in moist condition.

6. Seeding Coverage. Check coverage of seeding.

7. Surface Preparation. Spot check the prepared soil to ensure that the top four inches or specified depth has been prepared as required.

8. Application Rate. Know the application rate of seed, fertilizer, and water for the operation.

9. Seasonal Considerations. Verify the season of the year for compliance with respect to seeding, planting, etc. The Project Engineer may waive specified requirements. Do not permit seeding or planting on frozen ground.

10. Watering/Maintenance. Know if water and maintenance are required. If specified, ensure that the irrigation or sprinkler system is completed and inspected.

212.2.2 During Construction

Consider the following guidelines during seeding, fertilizing and sodding:

1. Application Rates. Check for even distribution and rate of application for seed, fertilizer, water, etc. Check coverage of seed in remote areas.

2. High Wind. Watch for loss of seed and fertilizer in high winds and, where necessary, postpone application.

3. Quantity Checks. Check total quantities of seed or fertilizer used against the acreage covered. Retain empty bags until the number is recorded.

4. Drill Seeding. Verify that drill seeding is being performed at right angles to the slope. The seed should be drilled or sown to provide a 0.25-inch cover.

5. Fertilizer Treatment. Verify that the fertilizer is being worked into the top four inches of soil.

6. Mulching, Weed Free. Where mulch is required, see Section 213.

7. Mulch Tackifier. Ensure that the application rate is in accordance with the Contract Specifications.

8. Planting. Where plants are required, see Section 214.

9. Sod. Sod is to be fertilized after laying is completed and before soaking.

10. Maintenance. Seeded areas should be inspected frequently. Areas with failures must be repaired and reseeded.

212.2.3 After Construction

Check the Contract Specifications for landscape maintenance requirements.

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SECTION 213
MULCHING

213.1 GENERAL

Mulching is specified on projects for both landscaping and erosion and sedimentation control purposes. In the context of erosion and sedimentation control, mulching is a soil stabilization Best Management Practice that protects the soil surface from raindrop impact and overland flow or runoff. Mulching generally consists of the application of plant residues or other suitable material to the soil surface. Typical mulching material includes straw, hay, and wood cellulose fiber and must be weed free. Contact the Natural Resources Staff in Environmental Programs for assistance.

213.1.1 Material Certification

Proper weed-free certification must accompany all mulch material before it is used within State right-of-way. The purpose of this certification is to prevent State noxious weeds from entering the State as discussed in Section 200.2.13. Verification of compliance is performed through visual inspection. Any one of the following indicates material acceptability:

- one of the bale ties is a length of orange and blue twine;
- one of the bale ties is a length of specially produced, shiny galvanized wire; or
- a Regional Forage Certification Program Tag, with appropriate certification number, is attached to the bale.

Do not allow the Contractor to unload any quantity of straw or hay or remove any identifying twine, wire, or tag before inspection by the Project Engineer. Also ensure that the Contractor supplies the transit certificate that has been signed by both the grower and a duly authorized representative of the Colorado Department of Agriculture.

213.2 INSPECTION GUIDELINES

213.2.1 Before Construction

Consider the following guidelines before the weed-free mulching operation begins:

1. Contract Plans and Specifications. Review the Contract for the areas to be treated and any special requirements

2. Slopes/Staking. Verify slope adequacy and any staking for the areas to be mulched. Ensure the Contractor fully understands the limits of mulching.

3. Mulching Method. Understand the proper operation of the mulching method that will be used (e.g., mechanically crimped, hydraulic).

4. Materials. Verify that the proper type of mulch has been provided. Check mulch for freshness. It should be expandable and springy. Reject mulch that is discolored, brittle, rotten, moldy, or decayed. At a minimum, 50 percent of the mulch, by weight, should be 10 inches or more in length. Retain supplier certificates indicating dry weight for the project records. Hay should consist of native grasses free of State noxious weeds. Straw should consist of clean cereal shafts that are free of weeds that are named on the Noxious Weeds List. Tackifier will be a free flowing non-corrosive powder without mineral filler, recycled cellulose fiber, clays, or other substances that will inhibit plant growth.

5. Application Rate. Know the specified rate of application for the specific type of mulch material and method of application to be used.

213.2.2 During Construction

Consider the following guidelines where mulching is performed:

1. Application. Applied mulch depth should not be less than one inch and not more than two inches. The mulch should be uniformly applied so that no more than 10 percent of the soil surface is exposed. Compare weight certificates against the area mulched to determine if the mulch was applied at the specified rate.

2. Anchoring. Check method of securing mulch to the ground and depth of anchoring. Hay and straw mulch should be anchored to the soil surface using a tackifier, blanket, or net, or with a mulch crimping machine. Mechanical anchoring, or crimping, is preferred and recommended for slopes flatter than 2:1. Blankets or nets on slopes steeper than 2:1 should be anchored to the soil.

3. Tackifier Slurry/Application. Tackifier used for anchoring is generally applied in a slurry with water and wood fiber (e.g., 100 pounds of powder/150 pounds of fiber/ 700 gallons of water). Application rate of the powder should be between 80 to 200 pounds per acre.

4. Seeding. Mulch should be applied immediately after seeding.

5. Mechanical Method. Consider the following factors where a mechanical application method is used:

   - uniformity of application (i.e., hay, straw);
   - crimping method;
   - application within 24 hours of seeding; and
   - areas designated for burlap or blanketing.

6. Hydraulic Method. Consider the following factors where a hydraulic application method is used:

   - quantity proportions in slurry tank;
   - uniformity of application; and
   - mulching area free from surface water.

7. Maintenance. Inspect frequently and reapply mulch where necessary.

213.2.3 After Construction

Check the Contract Specifications for maintenance requirements.

SECTION 214
PLANTING

214.1 GENERAL

Planting is specified on projects for both landscaping and erosion and sedimentation control purposes. Contact the Natural Resources Staff in Environmental Programs for needed assistance.

214.2 INSPECTION GUIDELINES

214.2.1 Before Construction

Consider the following guidelines before the planting operation begins:

1. Planting Layout. Understand the planting layout that is included in the Contract.

2. Utilities. Verify that planting locations have been properly coordinated with existing utilities and any utilities that will be adjusted or relocated. Also consider any proposed utilities.

3. Plant Types. Check that plants have been properly labeled regarding species and variety with respect to the requirements of the Contract Plans. Verify that the specified types and sizes are provided according to the Plant List in the Contract.

4. Plant Condition. Check quality and size against the requirements in *American Standards for Nursery Stock*, Contract Plan tabulations, and the Contract Specifications. Verify that the plants supplied are healthy with well-developed branch and root systems. Reject all plants on which roots have become dry or damaged. Check foliage for wilting or dryness. Observe any obvious signs of insect or other damage. Verify balled and burlapped plants for a solid ball that

conforms to specified dimensions. Check for broken, cracked, soft or pliable balls. Such types of damage are general grounds for rejection.

5. Certification. Check plants, trees, shrubs, vines, and ground cover for compliance. Check the certificates of inspection for plants, trees, and shrubs (e.g., inspected at nursery, Contractor-furnished samples). Do not accept plants without certificates. Retain certificates for the project records.

6. Season. Check that the planting will be performed during the appropriate season. Verify whether the plants should be balled and burlapped or container grown.

214.2.2 During Construction

Consider the following guidelines during the planting operation:

1. Shipping/Handling. Check that the shipping and handling of plants are meeting specified requirements. Check for any damage caused by shipping and handling.

2. Plant Location. Check that trees and shrubs are planted according to the Contract Plans, especially with regard to the required roadway clear zone and sight distance. Check for any conflicts with utilities or underground and overhanging structures, and have plants relocated where necessary.

3. Ground/Plant Preparation. Verify that the soil has been properly prepared with the proper type and quantity of soil conditioner and fertilizer. Check that the type of material used for this purpose has been properly approved. Check depth and diameter of planting hole and spacing in beds. Topsoil and soil preparation are generally rototilled prior to planting ground cover type plants.

4. Plant Preparation. Observe the preparation of plants. Plants must be prepared according to specified requirements (e.g., soaked, unwrapped). Pruning must be performed using good tree-surgery practices.

5. Backfill. Check that plants are properly backfilled with the specified soil conditioner and fertilizer. Saucers are to be covered with approved moist wood chip mulch.

6. Staking. Deciduous and coniferous trees generally should be staked for stabilization purposes. Verify that trees are staked as specified. Verify staking locations based on prevailing wind direction. Check that the operation is being performed without damage to the tree (e.g., damage from guy wires), and that the tree trunks are being wrapped as required.

7. Maintenance. Verify that the Contractor provided for watering and maintenance of the plants as specified in the Contract.

214.2.3 After Construction

Check the Contract Specifications for maintenance requirements.

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SECTION 215
TRANSPLANTING

215.1 GENERAL

Transplanting is specified on projects for both landscaping and erosion and sedimentation control purposes. Salvable trees and shrubs that can be transplanted to other locations on the project will be designated in the Contract Plans. Contact the Natural Resources Staff in Environmental Programs for needed assistance.

215.2 INSPECTION GUIDELINES

215.2.1 Before Construction

Consider the following guidelines before the transplanting operation begins:

1. Contract Plans and Specifications. Review the Contract for any special requirements of the operation. Verify plant dormancy requirements before transplanting.

2. Marking/Staking. Verify that trees and shrubs to be transplanted have been properly marked and that information has been communicated to the Contractor. Fully understand those plants that are to remain (i.e., marked for protection, trimming, targets for grubbing).

3. Utilities. Verify that transplanting locations have been properly coordinated with existing utilities and utilities that will be adjusted or relocated. Also consider any proposed utilities.

4. Season. Check that the transplanting will be performed during the appropriate season.

215.2.2 During Construction

Consider the following guidelines during the transplanting operation:

1. Roots. Verify that the root system of the plants is being properly pruned, and that the minimum diameter of the balled root system is being maintained.

2. Spraying. Check that plants are sprayed as specified in the Contract. Pay particular attention to the type of spray being applied and any special precautionary measures that are required. Spraying should not be performed in high winds.

3. Pits. Verify that plant pits are the appropriate size. Check that trees remain in the machine spade ready for transplant and that the pits are sufficient in dimension for the machine-dug root ball.

4. Backfill. Check that backfill is being properly worked and watered.

5. Water Basins. Verify that water basins are of appropriate capacity and filled with water at proper intervals.

6. Saucers. As specified, check that saucers are being covered with approved moist wood chip mulch.

7. Fertilizer. Check that the type and application rate of fertilizer conforms to specified requirements.

8. Schedule Considerations. Plants should generally be transplanted the same day they are removed from the ground.

9. Maintenance. Check that transplanted trees and shrubs are being maintained properly and watered as specified in the Contract.

215.2.3 After Construction

Transplanted trees shall be subject to a 180-day maintenance period. Guying material shall be removed after the 180-day establishment period.

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SECTION 216
SOIL RETENTION COVERING

216.1 GENERAL

Soil retention covering is typically specified on projects for the purpose of erosion and sedimentation control. In this context, blankets are used to stabilize the soil and protect it from raindrop impact and overland flow or runoff. Areas to be treated will be designated in the Contract Plans. Contact the Natural Resources Staff in Environmental Programs for assistance.

216.2 INSPECTION GUIDELINES

216.2.1 Before Construction

Consider the following guidelines before soil retention covering is placed:

1. Contract Plans and Specifications. Review the Contract for the type of material to be used and any special requirements of the operation.

2. Marking/Staking. Verify that areas to be treated have been properly marked or staked. Ensure the Contractor fully understands the limits of treatment.

216.2.2 During Construction

During construction, verify that blanket material conforms to specified requirements and is placed in the areas designated for treatment. Verify the correct placement of blankets with respect to unrolling and overlapping requirements. Ensure that the blankets are being maintained properly.

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SECTION 217
HERBICIDE TREATMENT

217.1 GENERAL

Herbicide treatment is typically specified to eradicate or otherwise control plant material on the project right-of-way or control weeds that are listed on the Noxious Weeds List. Areas to be treated will be designated in the Contract Plans. Contact the Natural Resources Staff in Environmental Programs for assistance.

217.2 INSPECTION GUIDELINES

217.2.1 Before Construction

Prior to construction, the Region Maintenance Noxious Weed Coordinator should be notified of the location and time when spraying will be performed. Consider the following guidelines before herbicide treatment is performed:

1. Contract Plans and Specifications. Review the Contract for the type of herbicide to be used and any special requirements.

2. Marking/Staking. Verify that the areas to be treated have been properly marked or staked. Ensure the Contractor fully understands the limits of treatment.

3. Safety Precautions. Fully understand the safety precautions for the particular herbicide to be used. Verify that the Contractor understands these requirements.

4. Material/Labels. Check that the type of herbicide provided meets the specified requirements. Verify the herbicide is properly labeled and the Contractor has furnished the necessary label information. Retain the label information in the project files.

5. Licensing. Verify that the Contractor has furnished the required documentation regarding applicator licensing. Retain this documentation in the project records.

217.2.2 During Construction

Consider the following guidelines during herbicide treatment:

1. Mixing/Application. Verify that the Contractor mixes and applies the herbicide in accordance with the manufacturer's recommendations.

2. Weather Conditions. Verify that the weather conditions are appropriate for application. Herbicide should not be applied during high winds. Review the manufacturer's recommendations for adverse weather conditions.

3. Overspray. Check that the Contractor's methods of controlling overspray meets specified requirements.

SECTION 250
ENVIRONMENTAL, HEALTH, AND SAFETY MANAGEMENT

250.1 GENERAL

This section provides environmental, health, and safety management considerations related to contaminants that may be encountered on the project. Section 107 and Section 250 of the *Standard Specifications* govern the Contractor's obligations and legal responsibilities for related topics.

250.2 HAZARDOUS MATERIAL/HAZARDOUS WASTE

250.2.1 Governing Specifications and Procedural Directives

Where hazardous materials and hazardous wastes are encountered, Section 250 of the *Standard Specifications* will govern the actions and activities of all construction personnel. Review *CDOT Procedural Directive 89.2 – Medical Monitoring for Hazardous Materials Workers* to identify which CDOT personnel assigned to the project will require medical monitoring, and become familiar with the monitoring procedures. Contact the CDOT Safety Officer of the Maintenance and Operations Branch at (303) 273-1849 for assistance.

250.2.2 Site Investigation

If hazardous materials and/or hazardous waste have been identified within the proposed limits of construction, such areas will be designated in the Contract. Verify that the Contractor has been properly informed with respect to site location and special requirements. Check that such areas are clearly marked.

250.2.3 Importance of Records and Documentation

It is important that complete and accurate records and documentation be maintained throughout the course of processing a hazardous material or hazardous waste discovery. Written notes, reports, detailed cost records, photographs, and videos all should be considered. Such records will assist CDOT in cost recovery and possible litigation.

250.2.4 Create Notification Form for Emergency Response

When the project first starts, the Project Engineer will prepare a list of contact names and telephone numbers to use in the event of a hazardous material/hazardous waste situation. Figure 200A presents a form for the recommended flow of notification. Complete and post this form in an obvious location within the project field office.

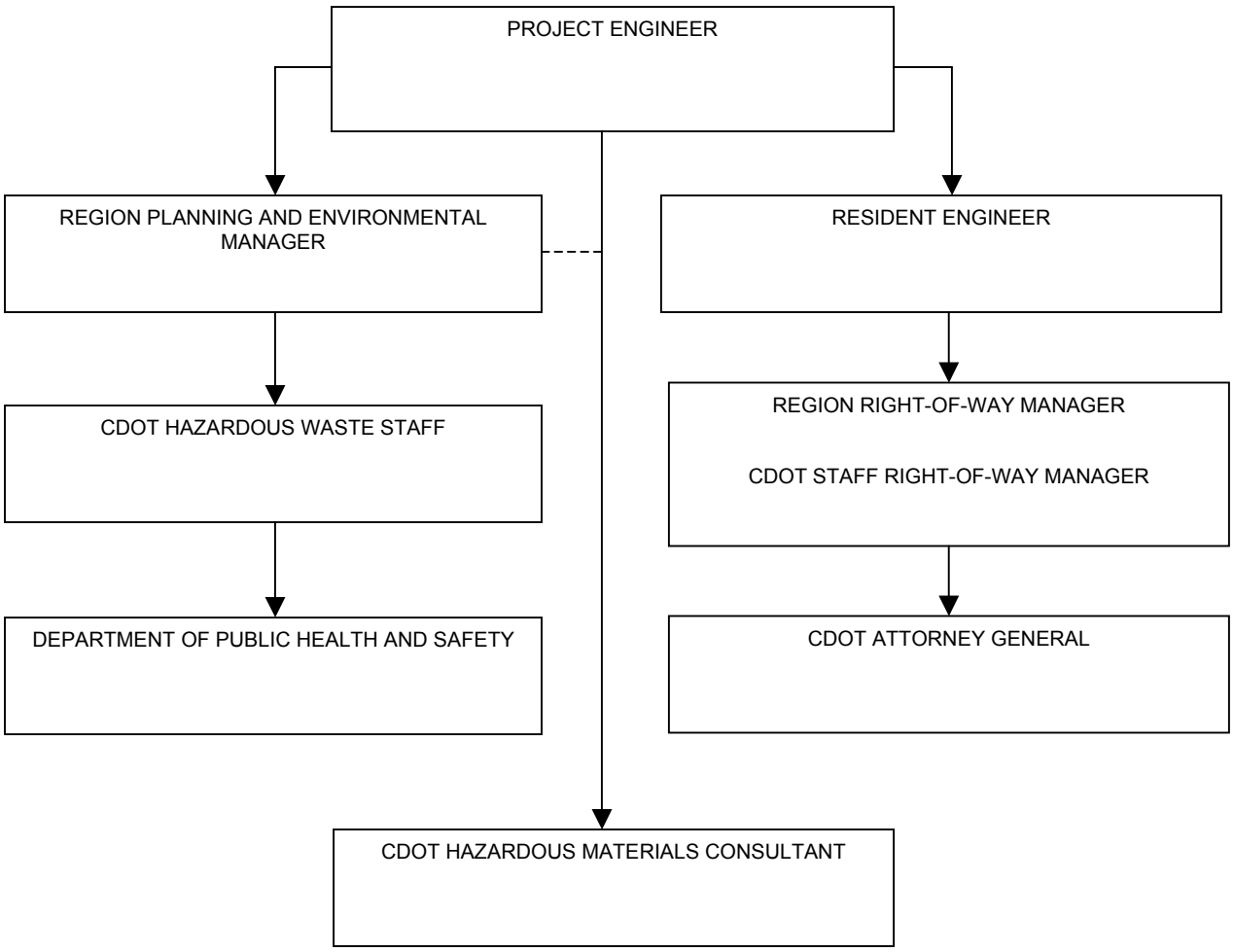
250.2.5 Discovery During Construction

Where hazardous materials are discovered during construction, pay particular attention to the encounter and treat each situation uniquely. Use common sense, remain calm, and stay alert. Use the procedural flowchart in Figure 200B to mitigate and contain the situation and obtain the needed assistance from hazardous-material experts and specialists (e.g., CDOT Staff, CDOT Hazardous Materials Consultants, State and local health officials). The following sections loosely correlate with the steps in the flowchart.

250.2.5.1 Potential Discovery Situations

Be aware of the possibility of encountering a hazardous material/hazardous waste situation during construction. Upon discovery of a potential hazardous substance, do not open any closed container or otherwise attempt to identify the substance. Halt work, and follow the flowchart procedures in Figure 200B. Immediately notify the proper authorities (see Section 250.2.5.4). Consider the following:

PROJECT NUMBER: _____ LOCATION: _____



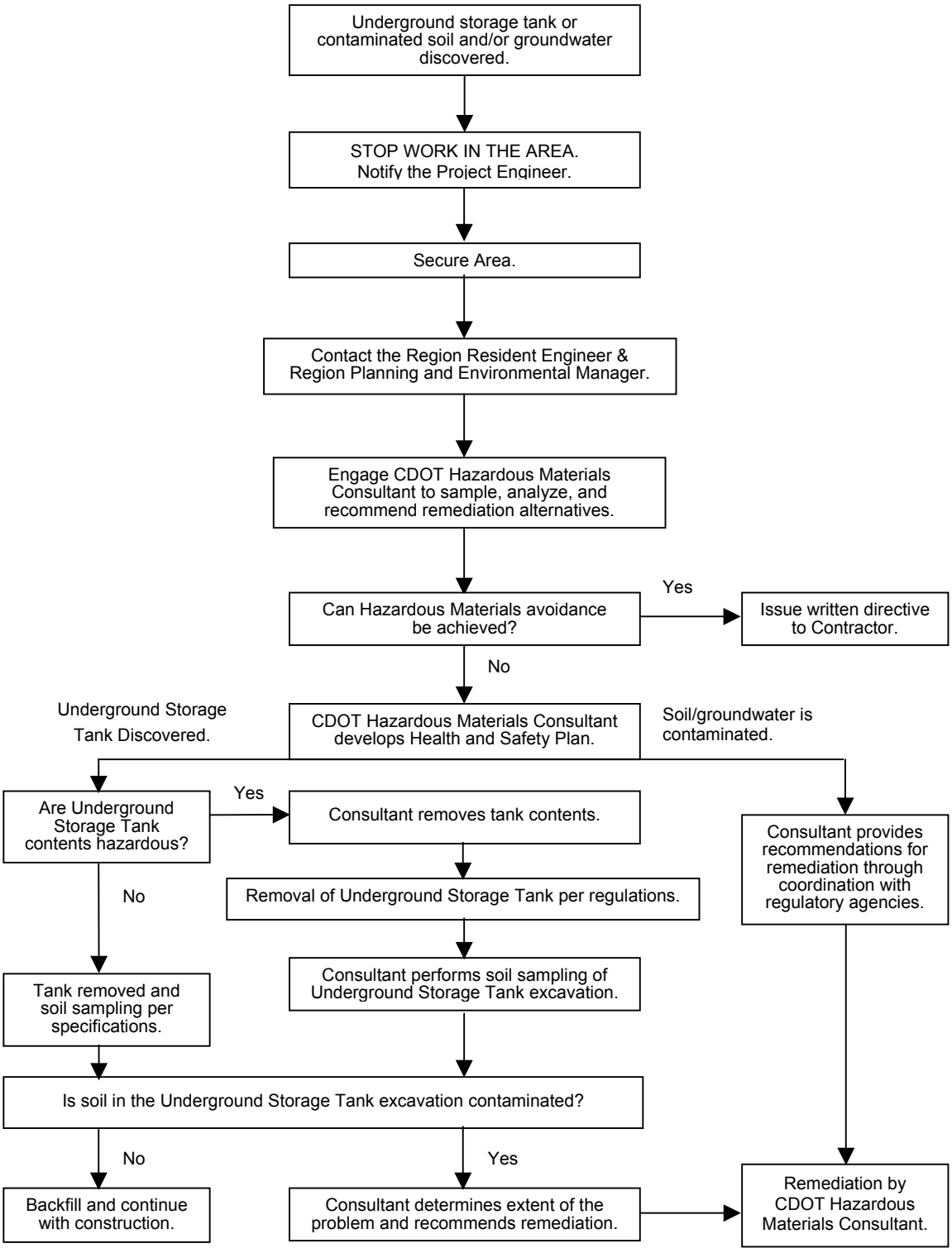
EMERGENCY RESPONSE PHONE NUMBERS:

Emergency Notification (where available) 911

State Patrol – Dispatcher (24 Hours) ..... (303) 239-4501

State Patrol – Local (24 Hours) ..... _____

NOTIFICATION FORM FOR CONTACT PHONE NUMBERS FOR HAZARDOUS MATERIALS SITUATIONS ENCOUNTERED DURING CONSTRUCTION
Figure 200A



PROCEDURES FOR HAZARDOUS MATERIAL/HAZARDOUS WASTE SITUATIONS ENCOUNTERED DURING CONSTRUCTION

Figure 200B

1. Excavation. Hazardous substances could be encountered during excavation. Treat all underground storage tanks, buried containers, and suspect soil and groundwater as potential hazards. Obnoxious fumes, unusual odors, discolored soils, water surface sheen, and visible fumes and smoke are key indicators.

2. Illegal Dumping. Be aware that hazardous materials could be illegally dumped within the right-of-way during off-shift hours. Use common sense and collaborative judgment to assess the nature of the encounter. Treat suspect containers and materials as potential hazards.

3. Construction Mishaps. Construction personnel and equipment operations could inadvertently rupture a natural gas or petroleum pipeline or cause a large fuel or chemical spill. Treat such incidents as a hazardous-material situation.

250.2.5.2 Stopping Work

Upon discovery of a suspect substance, immediately notify the Project Engineer. A written directive to stop work in the vicinity of the suspect substance will be issued to the Contractor. This action is necessary to avoid health risks to all personnel at the site and the general public. Health and safety take precedence over construction costs and delays. People who have come into direct contact with suspect substances (e.g., skin contact, inhalation) or exhibit adverse reactions should receive immediate attention by authorized medical personnel. People who have been exposed to suspect substances also should be monitored for adverse delayed reactions based on the recommendations of authorized medical personnel.

250.2.5.3 Securing the Area

After work has been stopped, the area surrounding the suspect substance must be secured to prevent inadvertent or unauthorized access by personnel or the general public. Treatments generally consist of cordoning the area, installing temporary fencing, and/or rerouting traffic patterns. Specific actions will depend on the scale, severity, and

nature of each situation. In addition, each situation will require appropriate administration of the Contract. After the area has been properly secured, the Project Engineer should consider practical alternatives for the Contractor to continue work on the project. If unavailable, document work delays, because Contractor negotiations may be necessary.

250.2.5.4 Emergency Contact Notification

In a situation where an extremely hazardous or life threatening substance is encountered, immediately notify the following:

- 911 Emergency Response (where available);
- Colorado State Patrol 24-hour line at (303) 239-4501;
- local fire department; and
- Colorado Department of Public Health and Environment, Emergency Response Section at (303) 756-4455.

A coordinated effort is necessary to properly address each hazardous material/ hazardous waste situation. To provide continuity within the project, the Project Engineer should always be kept informed. It is extremely important to maintain complete and accurate records (e.g., contacts made, recommendations, decisions, planned and completed activities, schedules). Figure 200A presents the minimum recommended notification procedures. Key contacts are as follows:

1. Project Engineer. After the Project Engineer has been notified, the Project Engineer will contact the Region Resident Engineer and the Region Planning and Environmental Manager. The Region Planning and Environmental Manager will provide guidance regarding the handling of suspect hazardous materials. Do not permit suspect soils which have been excavated to be rehandled unless otherwise recommended by the Region Planning and Environmental Manager.

2. Region Planning and Environmental Manager. The Region Planning and Environmental Manager will contact CDOT Hazardous Waste Staff in the Property Management Unit of the Maintenance and Operations Branch. As needed, the Region Planning and Environmental Manager will contact:

   - CDOT Safety Officer in Safety Services of the Maintenance and Operations Branch;
   - CDOT Staff in Environmental Programs of the Project Development Branch;
   - Emergency Response Section of the Colorado Department of Public Health and Environment; and
   - other State and local health and regulatory agencies, as needed.

3. Region Resident Engineer. The Region Resident Engineer or, as directed, the Project Engineer will contact the Region Right-of-Way Manager for assistance in investigating the substance encroaching private property, originating source of the material, and ownership.

4. Region Right-of-Way Manager. The Region Right-of-Way Manager will coordinate with the CDOT Staff Right-of-Way Manager in Right-of-Way Programs of the Project Development Branch to determine if it is necessary to contact the CDOT Office of the Attorney General with regard to liability, cost recovery, and documentation issues. If a claim against the State Petroleum Fund is probable, contact Environmental Programs for guidance on record maintenance for the reimbursement application.

5. Other Notifications. Other notifications may be necessary as follows:

   a. Office of Public Relations. The CDOT Office of Public Relations should be notified in the event of any situation adversely affecting the general public or if media involvement is imminent. During office hours call (303) 757-9228 and after office hours call (303) 829-4679.

b. FHWA. If the project has Federal oversight, immediately inform the FHWA Design/Environmental Engineer at (303) 969-6730 of the situation.

For additional information, see the *CDOT Guide to Hazardous Materials Response on State Highways*, and contact the CDOT Safety Officer of the Maintenance and Operations Branch at (303) 273-1849.

250.2.5.5 Hazardous Material/Hazardous Waste Consultants

The Department maintains Consultant contracts for hazardous material/hazardous waste services. The Project Engineer and the Regional Planning and Environmental Manager will determine the scope of services required and whether a Consultant is needed. If needed, the next available candidate, not having a conflict of interest, will be selected, and the Project Engineer will initiate procurement with the Center for Procurement Services. To better assess the feasibility of complete or partial avoidance of the hazardous material/hazardous waste encounter, the Department will typically request recommendations from Consultants based on risk assessment and feasibility studies of various alternatives.

250.2.5.6 Assessment of Avoidance Alternatives

Alternatives to completely or partially avoid the hazardous materials are preferred. The Project Engineer, Region Planning and Environmental Manager, and Region Resident Engineer will initially assess the feasibility of complete avoidance. As needed, CDOT Staff in the Project Development Branch will assess the feasibility of design revisions, partial deletions of work, and construction alternatives. CDOT will also consider the feasibility of terminating the Contract based on the scope of the situation, the costs of other alternatives, the anticipated magnitude of claim settlements, and the project's significance to public safety and other planned improvements. If complete avoidance is not feasible, alternatives for partial avoidance will be considered to minimize health risks. Avoidance alternatives require the Contractor's Health and Safety Officer to prepared and follow a Health and Safety Plan, as governed by Section 250 of the *Standard Specifications*.

If complete avoidance is selected, the Project Engineer will issue the Contractor a written directive addressing changes to the project and revisions to the Contract. One copy of the written directive should be forwarded to the following:

- Region Resident Engineer,
- Region Planning and Environmental Manager,
- Region Right-of-Way Manager,
- CDOT Staff Right-of-Way Manager,
- CDOT Hazardous Waste Staff, and
- other individuals as deemed appropriate.

Cost and delay issues will probably necessitate Contractor negotiations and may require a change order. It is therefore important to develop and maintain complete and accurate records. As needed, request a revised progress schedule from the Contractor to address the changes to the project.

250.2.5.7 Health and Safety Plan Implementation

Based on the requirements of Section 250 of the *Standard Specifications*, the Contractor's Health and Safety Officer is responsible for preparing and implementing a Health and Safety Plan to proceed with construction. The Health and Safety Plan, as well as the associated plan for site investigation, must properly reflect the requirements of Federal, State, and local regulatory agencies. Concurrence of the Chief Engineer and the FHWA Design/Environmental Engineer also may be required before work proceeds. Development and implementation will significantly involve the services of the CDOT Hazardous Material/Hazardous Waste Consultant assigned to the project. The Project Engineer will prepare and forward a written directive to the Contractor addressing specific requirements. Consider the following:

1. Site Investigation Plan. Prior to developing the Health and Safety Plan, the Contractor's Health and Safety Officer will prepare and implement a detailed work, sampling, and analysis plan to characterize and define the horizontal and vertical limits of contamination. The CDOT Hazardous Material/Hazardous Waste Consultant and the Region Planning and Environmental Manager will review this

plan and recommend acceptance, revision, or rejection to the Project Engineer. Upon acceptance, the investigative work will proceed. The CDOT Hazardous Material/Hazardous Waste Consultant will oversee the work for compliance and review analytical reports prepared by the Contractor's personnel.

2. Health and Safety Plan. Based on the results of the site investigation, the Contractor's Health and Safety Officer will prepare a Health and Safety Plan to proceed with construction. The Plan will indicate the necessary training of CDOT and Contractor personnel. The CDOT Hazardous Material/Hazardous Waste Consultant will oversee implementation and report instances of non-compliance immediately to the Project Engineer.

3. Change Order. The Project Engineer is responsible for preparing the change order necessary to address the implementation of Section 250 requirements.

250.2.6 Signature Authority for Manifests

Waste manifests (i.e., chain-of-custody forms) for hazardous materials and hazardous wastes must be properly signed by authorized personnel. Ensure that a copy of the signed manifest is forwarded to the CDOT Records Center with the appropriate project number and project code.

Either the Region Planning and Environmental Manager or his staff is qualified to sign manifests. The project personnel are qualified to sign manifests if they have had proper and adequate training in the disposal of hazardous materials and hazardous waste.